

Integrated Deployment & the Greensburg Impact



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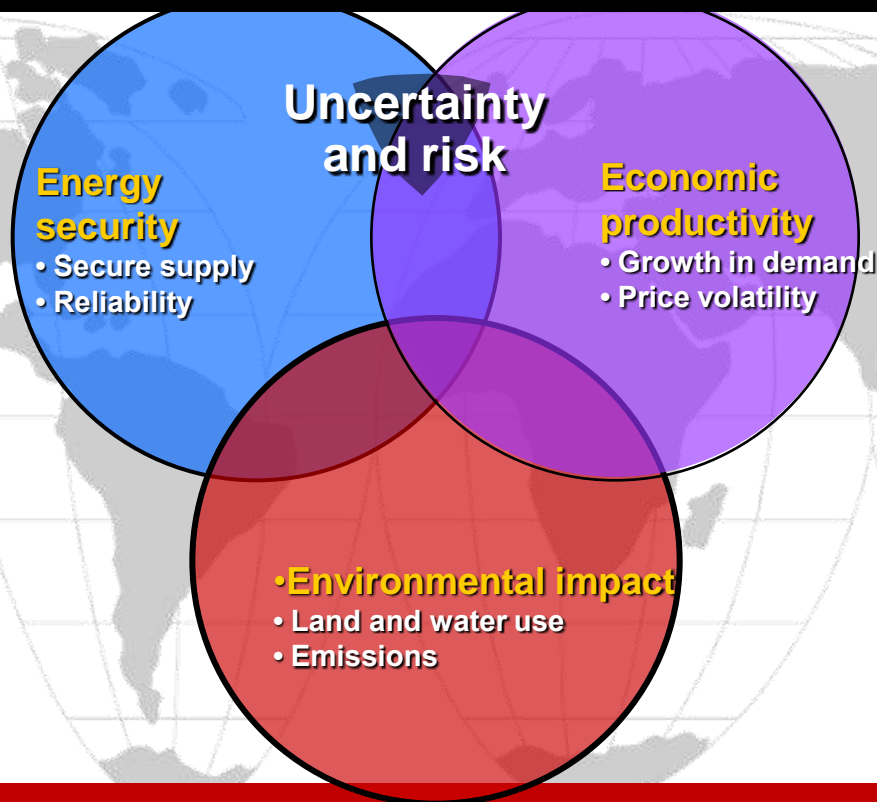
Leading the Nation in Deploying Clean Tech



Our mission is to accelerate market adoption of alternative energy solutions to power our homes, businesses and vehicles through a comprehensive and aggressive approach.

The Energy Challenge

How does the US take a strategic, comprehensive, and aggressive approach towards reducing carbon emissions and oil consumption by 50% by 2030 and 80% by 2050?

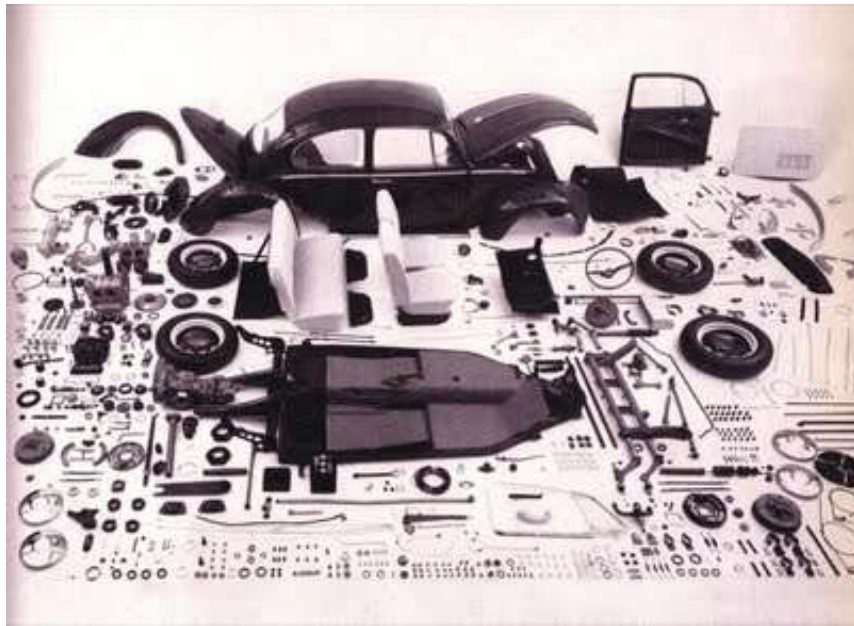


We need a balanced portfolio of options—
including clean, domestic energy technologies.

What's missing?

The Integration

The whole is greater than the sum of the parts



Clean Energy
Future

The Concept:

Clean Energy Transformational Change

Develop an Approach That Provides:

- A comprehensive & aggressive way to address clean energy
- A focus on transformational, systemic change
- A multi-dimensional, multi-technology approach to energy sources, generation, and end use
- An approach that addresses cross-technology linkages and gaps
- A model for the rest of the world to follow
- A vehicle to accelerate market adoption of clean energy solutions
- A way to integrate DOE's current deployment efforts



The Concept:

Enable EERE Technologies at Speed and Scale

Goal: Enable Deployment of Renewable Energy and Efficiency Technologies and Practices at a Material Scale in an Aggressive Approach

- A Strategic Approach to Sustainable Development
 - Comprehensive, multi-technology approach driven by overall goals
 - Address supply & demand – Includes electricity, fuels, vehicles, buildings,
 - Tailored to indigenous resources and infrastructure
 - Addresses Technology, Policy, and Market Factors
 - A multi-year effort that focuses on transformational, systemic change
-

Integrated Deployment Encompasses NREL's R&D Portfolio

Foundational Science

Renewable Resources

- Wind
- Solar
- Biomass
- Geothermal



Efficient Energy Use

- Vehicle Technologies
- Building Technologies
- Industrial Technologies



Energy Delivery & Storage

- Alternative Fuels
- Hydrogen Delivery and Storage
- Electricity Transmission & Distribution

What does it take to achieve a comprehensive strategy toward Integrated Deployment of Efficiency and Renewables?

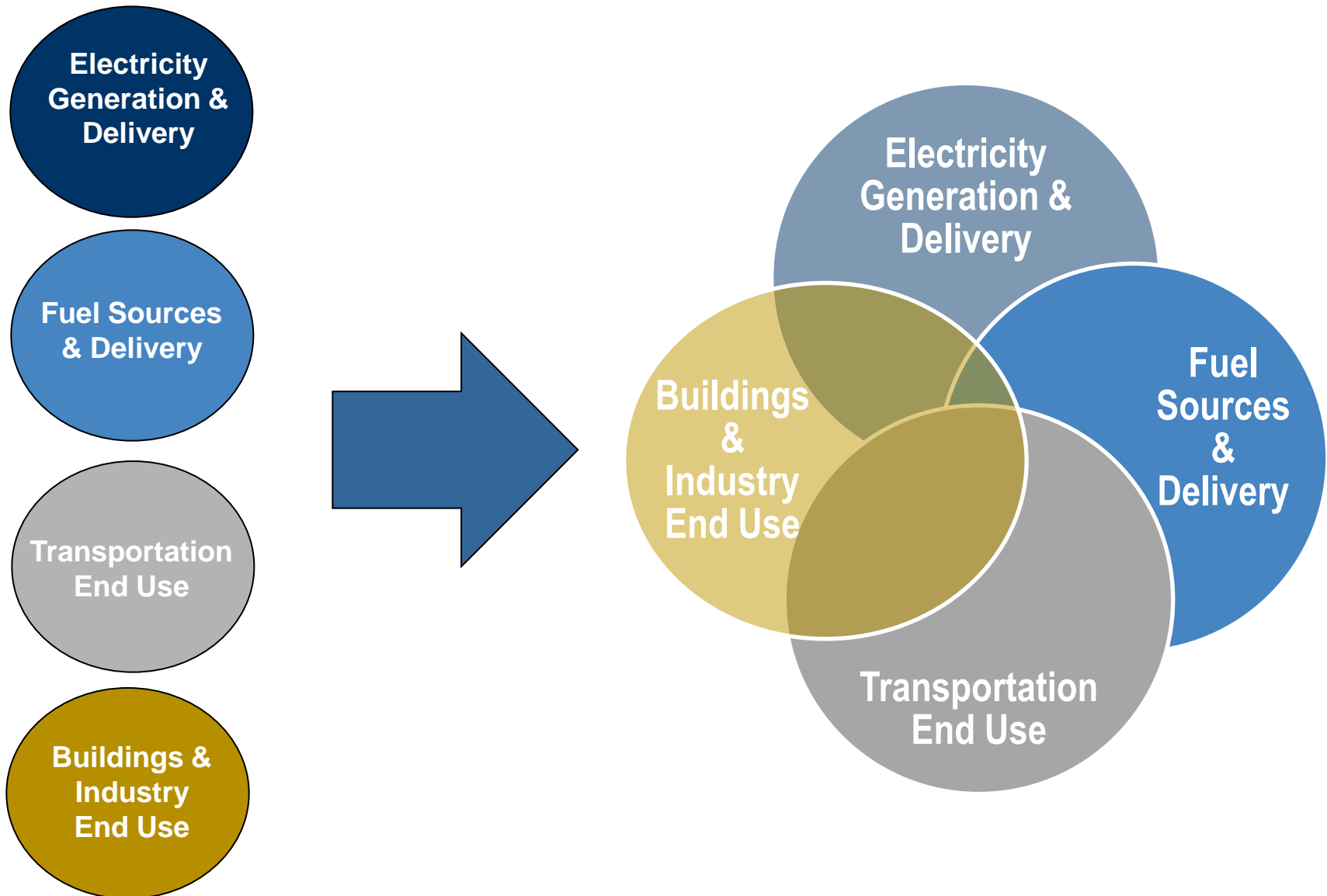
- Analysis
- Policy Changes
- Regulation Changes
- Leadership
- Examples
- Tools
- Financing
- Partners
- Commitment
- Buy-in
- A Vision
- A Plan
- Goals



Combining Technology Solutions with Deployment Strategies & Leveraged Partnerships Can Achieve A Transformational Outcome

Technologies	Deployment Strategies	Partnerships
<p>Efficiency</p> <ul style="list-style-type: none"> ▪ Residential ▪ Commercial ▪ Industrial <p>Renewable Generation</p> <ul style="list-style-type: none"> ▪ Solar ▪ Wind ▪ Geothermal ▪ Hydro / Wave / OTEC <p>Renewable Fuels</p> <ul style="list-style-type: none"> ▪ Biofuels ▪ Hydrogen <p>Transportation</p> <ul style="list-style-type: none"> ▪ Efficient Vehicles ▪ Electric Vehicles ▪ Alternative Fuel Vehicles <p>Grid System</p> <ul style="list-style-type: none"> ▪ Transmission ▪ Distribution ▪ Controls 	<p>Situational Assessment</p> <ul style="list-style-type: none"> ▪ Analysis ▪ Resource Assessment ▪ Policies & Barriers <p>Address Policy Opportunities</p> <ul style="list-style-type: none"> ▪ Codes and Standards ▪ Utility Programs ▪ Legislation ▪ Utility Regulations <p>Economic Evaluations</p> <ul style="list-style-type: none"> ▪ Financing Options ▪ Economic Development ▪ Business Case Development 	<p>Leadership</p> <ul style="list-style-type: none"> ▪ Vision & Goals ▪ Commitment & Dedication ▪ Strategy & Planning ▪ Political Will <p>Decision-makers</p> <ul style="list-style-type: none"> ▪ Drive policy change ▪ Drive regulatory change <p>Utilities</p> <ul style="list-style-type: none"> ▪ Motivated to Change ▪ Innovative <p>Partners</p> <ul style="list-style-type: none"> ▪ Buy-in ▪ Adoption ▪ Financing ▪ Successes

Technologies are the Core Focus



Deployment Strategies

Stakeholder Relations & Education/Outreach

“Ongoing dialogue”

- Working Groups - Onsite Support - Events
- Website Development - Coordination
- Workforce Development
- Training

Macro Analysis & Policy

“Thinking about the big picture”

- Macro studies - Modeling - Position Papers
- Legislative & Regulatory Analysis
- Scenario Analysis

Project Management

“Herding the cats”

- Strategy - Leadership
- Resourcing - Planning

Project Deployment/Demonstration

“Putting hardware on the ground”

- Partner Coordination - Risk Mitigation
- Negotiation Agent - Financing Support
- Transaction Process Support

Project Initiation

“Assessing the good ideas”

- Technology Assessments - Modeling
- Business Case Development
- Risk Assessment
- Partner Development

Integrated national expertise helping solve local energy challenges.

Integrating Technology & Deployment Strategies

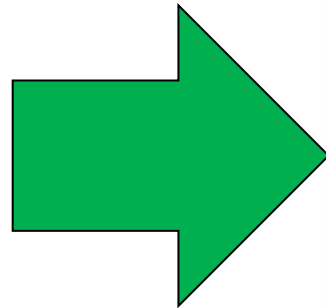
Stakeholder Relations & Education/Outreach

Macro Analysis & Policy

Project Initiation

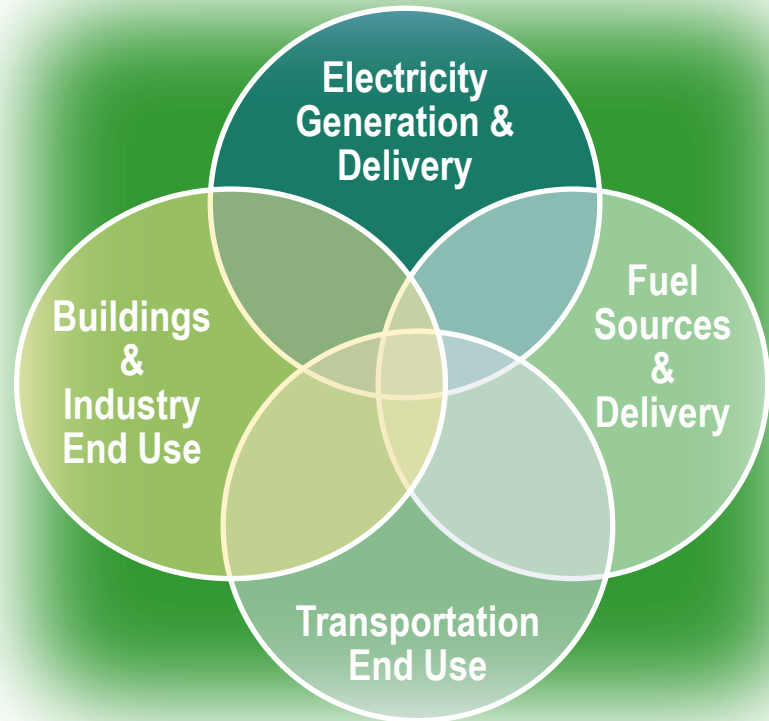
Project Deployment/
Demonstration

Project Management



Partnership Building & Communication

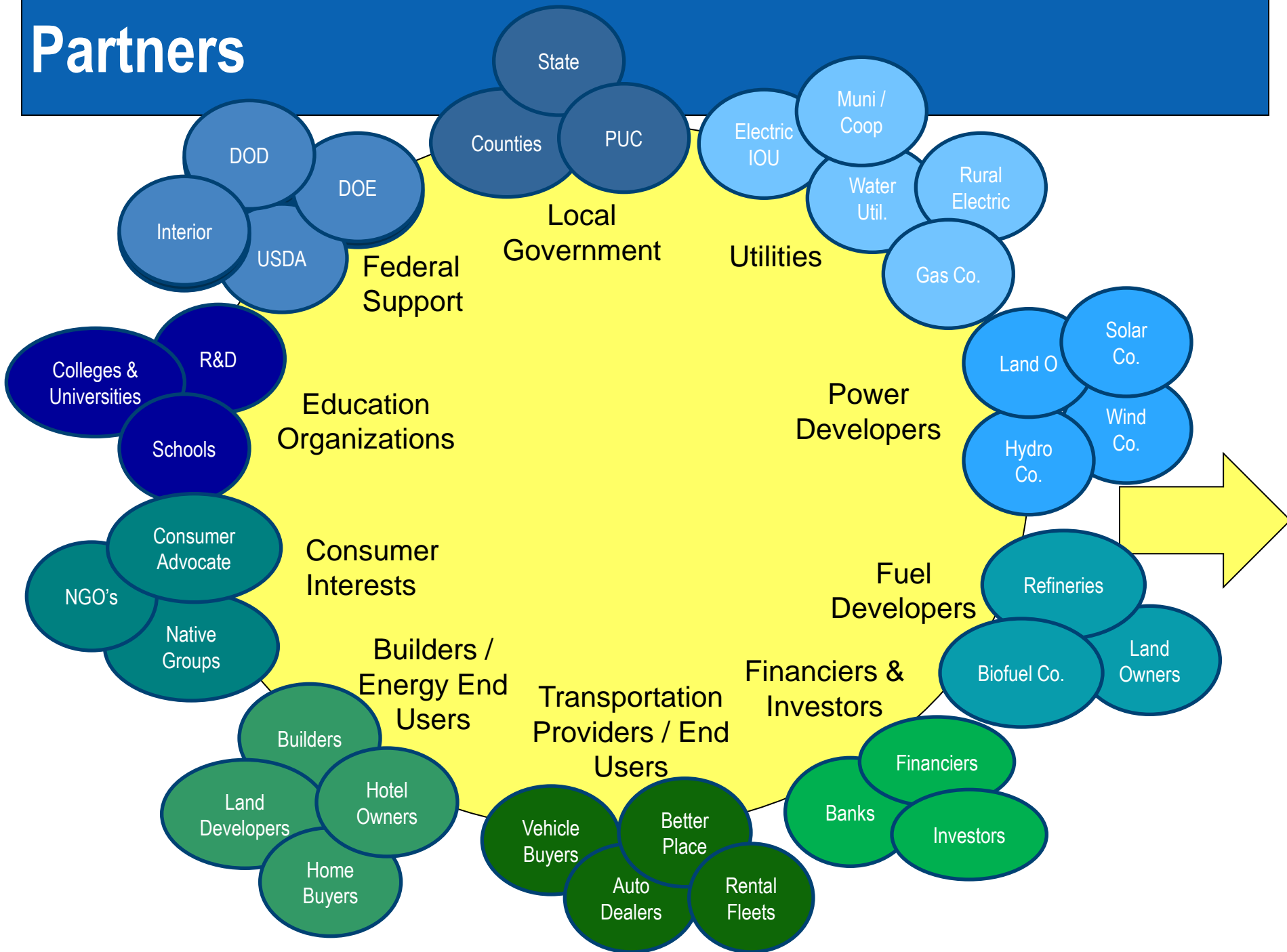
Policy & Analysis



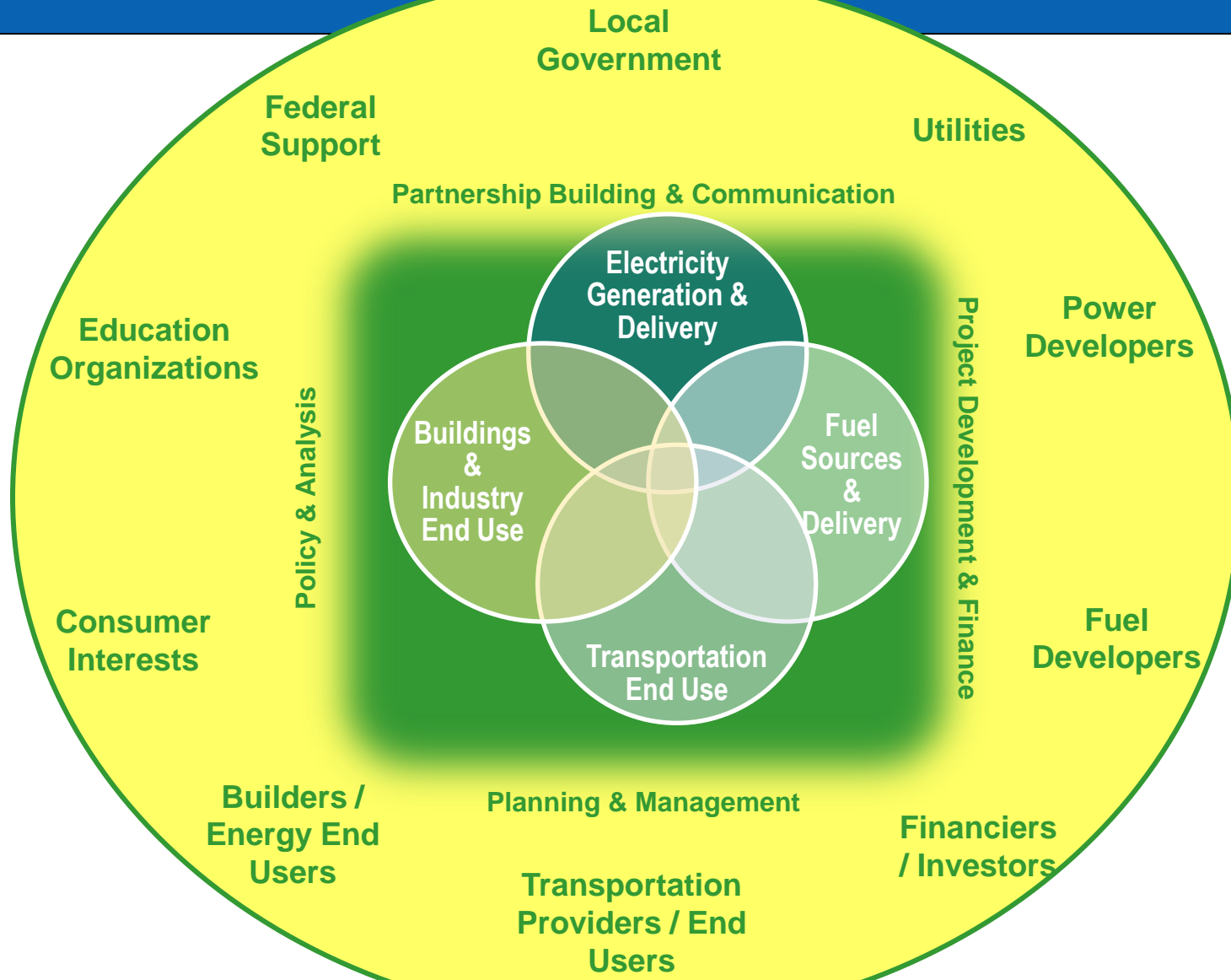
Project Development & Finance

Planning & Management

Partners



Integrating Partners with Technologies & Strategies



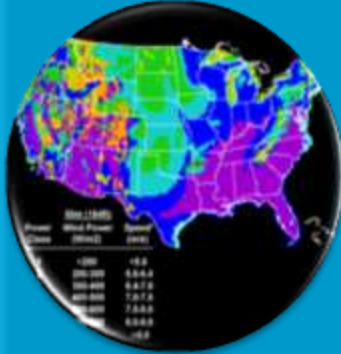
Integrated Deployment Model

Implementation Approach



Build Stakeholder Partnerships

- Vision
- Commitment
- Education & Outreach



Establish Analytical Framework

- Macro Analysis
- Baseline Development
- Use / Refine Tools
- Modeling
- Goal setting
- Plan Development



Advance Energy Policy

- Evaluate Policy Options
- Evaluate Regulatory Options
- Quantify & Qualify Option Impacts



Apply the Business Perspective

- Financing models
- Business Case Analysis
- Barrier Reduction
- Risk Mitigation
- Technical and economic viability

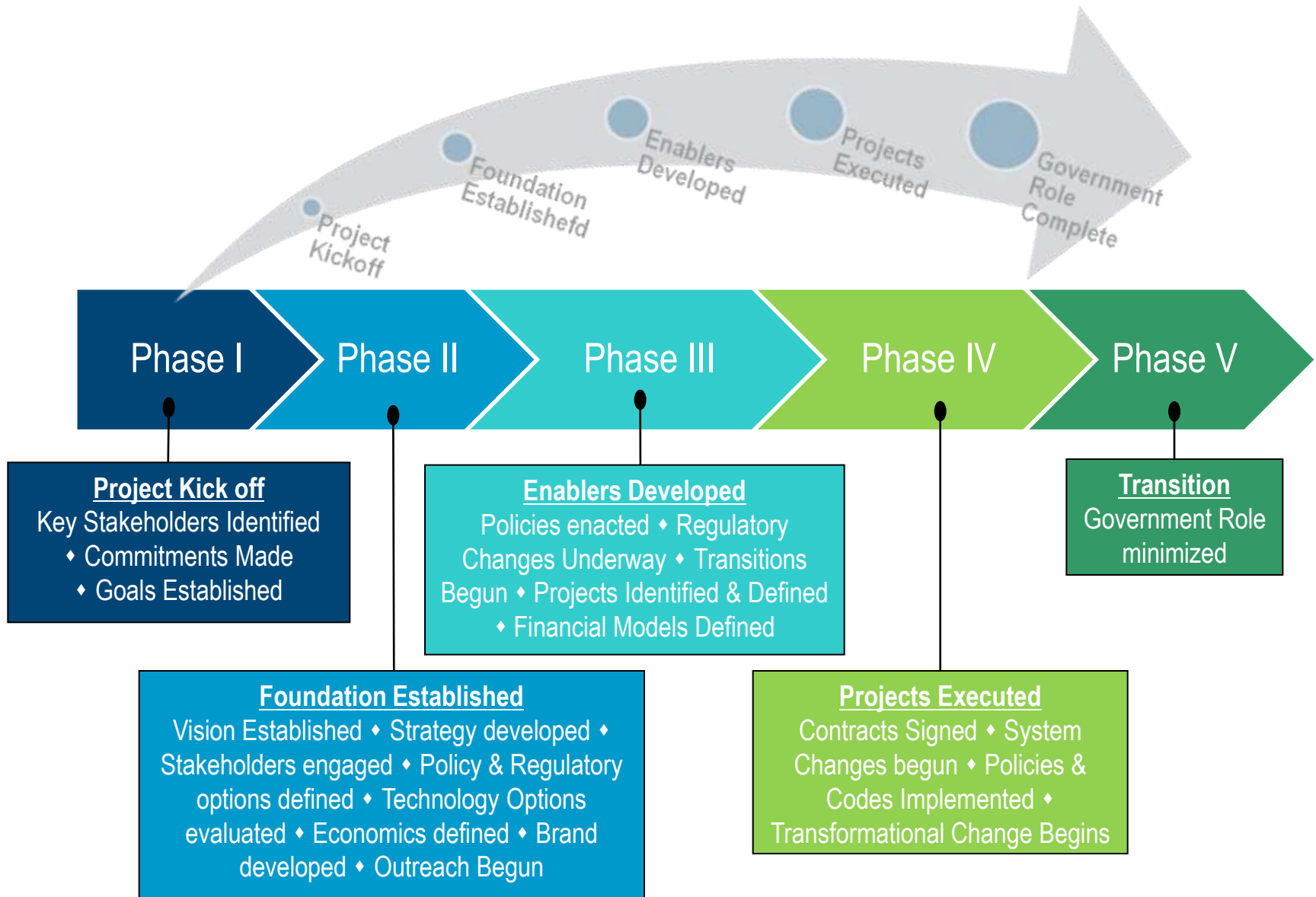


Get Early Successes

- Hardware Deployed
- Technology demonstrations
- Replication models



Project Timeline



Project Organization

Steering Committee / Management

Cross-cutting Areas

Planning & Reporting

Outreach & Education

Policy & Analysis

Project Development &
Finance

Technology Areas

Buildings / Industry End
Use

Electric Generation &
Delivery

Fuels

Transportation

An Aggressive Energy Approach Can be Taken at any Level



Community/City

NREL is leading DOE support in rebuilding New Orleans and Greensburg, KS in the most energy efficient and renewable way possible



State

NREL is leading DOE efforts in Hawaii and Alaska in their pursuit for efficient and renewable solutions to their dependence on fossil fuel



Federal

NREL is leading DOE support to the Department of Defense and National Science Foundation to pursue aggressive and comprehensive solutions to energy independence on military installations and reduced emissions in our polar regions.



Nation

EDIN 
Energy Development in Island Nations

NREL is leading DOE efforts in support of the international partnership for Energy Development in Island Nations, providing comprehensive energy solutions to island nations throughout the world.



Project Locations



Successes To Date:

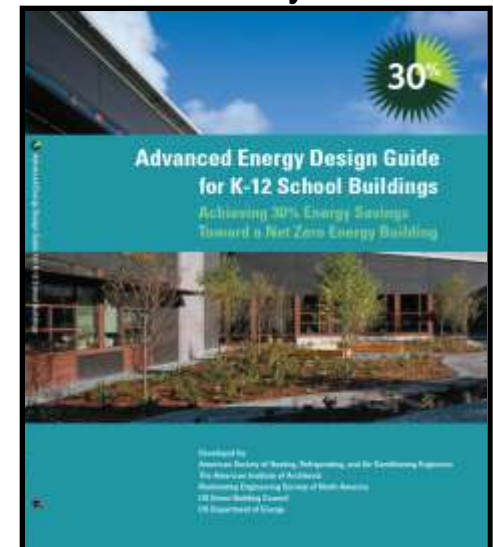
Disaster Recovery

■ Greensburg:

- First city to pass ordinance requiring all major govt. buildings meet LEED Platinum standard
- More LEED certified buildings per capita than anywhere in the world
- Average energy savings in new homes at 36% more efficient than code
- 12 MW of Wind Generation installed to provide 100% Renewable electricity

New Orleans:

- All new and major renovations of New Orleans Schools are 30% or more above the current energy standard
- Several successful housing projects at 30-50% more efficient than code
- Largest home builder elevated standard to Energy Star



Successes To Date:

Federal Agencies



Department of Defense:

- Selected pilot site to pursue Net Zero Energy Military Installation goal
- Analyzed and modeled energy use and renewable resource options at pilot site in Miramar, CA (Marine Corp base)
- Developing Plan for Net Zero Energy Implementation at Miramar Marine Corp base

NSF:

- 1.5 MW wind turbine on its way to the South Pole
- Installation of 3 wind turbines in progress on Ross Island
- Analysis for 100% renewable power for Black Island (Telecommunications for Antarctic-based operations)

Successes To Date:

States & Island Nations

Hawaii:

- 70% Clean Energy goal by 2030
 - largest state clean energy goal to date
- Electricity Standards Passed this Year
 - 40% RPS & 30% EEPS

EDIN

- Partnership established with NZ and Iceland
- US Virgin Islands selected as Pilot
 - Goal tentatively planned for 60% Clean Energy by 2025

Alaska

- On-site person established
- Supporting use of \$300M of State funds
- Supporting education and projects in native village areas



Keys to Success

- **Enable People and Businesses to do the Right Thing**
- **Establish Minimum Standards When it Makes Sense**
- **Establish Strong Leadership**
- **Identify Early Adopters**
- **Create Early Successes**



Lessons Learned

- Imperative to persistently educate all involved on life cycle cost of energy in buildings
 - Efficiency first, then renewables
- Consider all renewable resources; cost varies tremendously depending on resource and incentives
- Optimize at the system level
- Fully embraced and learn to use “Green” as an economic development tool
- Cultural change is required - prepare for it and address it
- Financing assistance (information and/or cash) is as important as technical assistance
- It's up to the Project Partners to make things happen

Greensburg Impact on the Private Sector

- **John Deere:** As a result of their experience and NREL assistance in Greensburg, John Deere supported a LEED Platinum dealership building in Greensburg; is building a new one in another Kansas community based on this design; and is publicizing this design as the recommendation for all new John Deere dealerships in North America.
- **BTI Equipment/John Deere:** As the owner of four John Deere franchises in Kansas, and well connected with the entire John Deere dealership network, BTI Equipment began a new division called BTI Wind; became the North American distributor for a growing Canadian wind turbine company called Endurance; formed a wind business network of more than 100 interested John Deere franchise holders in North America; has created at least 120 new wind-related jobs; and prompted the retraining of a couple hundred more technicians to expand beyond working on farm equipment to working on wind turbines.
- **Dillon's**, a major food chain in the Kroger family, is using energy efficiency techniques from Greensburg in other installations in the Midwest.
- Several architectural and design firms, operating within Kansas, the region, or the nation, went from knowing very little about the design of high-performance buildings (high energy efficiency and/or use of renewable energy as a result of NREL expertise in Greensburg. They are now focusing on green contracts for their business goals.
- **BNIM**, a major international sustainable planning and design architect, but formerly weak in energy modeling expertise
- **Health Facilities Group of Wichita**, had an excellent reputation for hospital design but knew nothing about high-performance building design or renewable energy; now they are in high demand for sustainable hospital design throughout the region and nation
- **Mennonite Housing** has built more than 500 homes and 450 apartment units since 1975, for low-income people and seniors in several counties in Kansas. Now, they have experienced designing and building 23 low-income homes that use half the energy of standard energy code in Greensburg, which will influence all their future projects.
- **Professional Engineering Corporation**, now succeeding on federal government bids because of their NREL/Greensburg training and experience
- **Hastco Builders of Emporia**, now one of the most experienced green commercial builders in Kansas
- **MVP Architects**, now one of the most experienced green architectural firms in Kansas.
- **Manske and Associates**, now using new whole building design experience throughout Kansas
- **Wardcraft**, designer and builder of pre-fabricated homes and commercial buildings throughout the region, developed a new high-efficiency design and is now using throughout the region

Greensburg Impact on the Public Sector

- **Department of Energy:** The extensive outreach and education approach used to document the lessons learned in Greensburg, and to share that information as broadly as possible, has become the model for at least two other NREL/DOE integrated deployment projects: the Renewable Communities project, and the New Orleans project.
- **Housing and Urban Development:** On January 12, 2010, Secretary Donovan held a multi-agency workshop convening 20 national and international experts on sustainable development and long-term disaster recovery, to inform the deliberations of the Interagency Long-Term Disaster Recovery Working Group, sponsored by HUD and Dept Homeland Security. This workshop focused on New York City and Greensburg, KS. Our Greensburg documents were included in the pre-workshop reading materials, and the executive director of our subcontractor Greensburg GreenTown, with whom we have worked extensively, was the invited panelist on Greensburg.
- **USDA:** Following the tornado, USDA officials in Kansas making funding decisions did not understand the importance and definition of highly energy efficient buildings. The State Director from 2007-2010 and his staff became very knowledgeable and great advocates for these new approaches, including campaigning up the USDA hierarchy to increase awareness of the need for key policy changes to permit funding of sustainable building features.
- **USDA:** Nine members of the House of Representatives' Select Committee on energy Independence and Global Warming signed a letter to the USDA Secretary following testimony by the city administrator of Greensburg in July 2008. This letter emphasizes the importance of energy efficiency and renewable energy in rural areas, and asked USDA to answer two specific questions regarding interpretation of their funding-related statutes and efficiency/renewable.
- **FEMA:** A similar experience happened with FEMA regarding new awareness of efficiency and renewable importance. This new level of awareness has not yet resulted in any policy changes for either agency, but important groundwork has been laid.

Greensburg Project Benefits to DOE and American Public

- Established a model for the nation
 - Showed how sustainable energy principles and practices can be incorporated into a community rebuilding after a disaster
 - Demonstrated the appropriate priorities for energy improvements in a community – planning, efficiency, and then most cost-effective local renewable energy resource
 - Documented the practical experiences – successes and failures -- of a rural community embracing to a green-oriented community direction and values, to inspire and inform similar communities
- Assisted DOE Program goals
 - Expansion of DOE Commercial Building Partnership with a key new partner (John Deere) (Bldgs)
 - Helped launch a new community-scale wind turbine company (BTI Equipment) that is providing new wind-related jobs in 32 states (Wind)
 - Provided an ideal community hospital partner for the DOE Smart Hospital program (Bldgs)
 - Developed first-ever energy efficiency guidelines for metal (Butler) buildings
- Influenced federal agency practices
 - USDA Rural Development and FEMA have a better understanding of energy efficiency and clean energy technologies (definition, need, cost, design)
 - USDA Rural Development has requested further assistance on green residential buildings and shown broad interest in NREL's deployment projects

Spreading the Story; Replicating the Model

- *Dozens of interviews, articles, and press to spread the word*
- *At least 65 Presentations Nationally and Internationally, including China and Australia*
- *Media coverage is unprecedented for a project of this size*
- *Disaster Recovery Story: Rebuilding Greensburg, Kansas, as a Model Green Community: A Case Study and numerous other publications provided to FEMA for distribution*
- *Thousands of visitors on DOE's Greensburg website and on the Greensburg Sustainable Building Database*

Thank You!

*Greensburg would not be the success it is without
the leaders and partners in Greensburg and
throughout the Nation.*

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